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The Tooth of Time
J. O. Wheeler

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The Tooth of Time: J. O. Wheeler

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This year geologists celebrate the bicentenary (1815–2015) of *A Delineation of the Strata of England and Wales, with part of Scotland*, by the English engineer and mineral surveyor, William Smith (1769–1839). Entirely self-motivated, his was not the first geological map ever made, but it was the first one to encompass an entire nation (Sharpe 2015; Sharpe and Torrens 2015). At a scale of five miles to the inch (1:316,800), it was printed on 15 sheets covering 4.68 square metres in all, individually hand-tinted with water-colours so as to show the surface extent of each stratum softly, but its base in sharp relief. Elements of Smith's colour scheme—green in the Cretaceous, blue in the Jurassic, grey in the Carboniferous—gained lasting international adherence. Ironically, there is no indication in Smith's public or private writings that he ever inferred, from the stratigraphic order he established, a depositional sequence in geologic time (Rudwick 2005). No matter, the map itself was transcendent.

This year will also be remembered for the passing of one of Smith's most successful modern map-making descendants, John O. Wheeler (1924–2015). Wheeler's crowning achievements were the *Geological Map of Canada* (Wheeler et al. 1996) and its companion, the *Geologic Map of North America* (Reed et al. 2005). Innovative in their day, they remain unsurpassed by any geological map at the classic scale of 1:5M. Earlier, his *Tectonic Assemblage Map of the Canadian Cordillera* (Wheeler and McFeely 1991) provided a common reference frame for a generation of Cordilleran geologists, analogous to Harold (Hank) Williams' *Tectonic Lithofacies Map of the Appalachian Orogen* (Williams 1978) and Phillip B. (Phil) King's *Tectonic Map of North America* (King 1969). J.O., as he was known, was a Cordilleran geologist first and foremost, based in Vancouver with the Geological Survey of Canada (GSC). But in the 1970s, my first decade with the organization, he was based in Ottawa first as Division Chief and then as Chief Geologist (Deputy Director-General). Soft-spoken and blessed with the happy ability to put anyone at ease, J.O. was especially loved by younger geologists because he habitually lingered around the poster booths at conferences, talking with them about their work. He often sought out junior research staff as sounding-boards for his ideas. J.O. rarely if ever talked about himself, so it was only during my voluntary secondment to the Vancouver office in 1973–74 that I began to piece together the history and background of the man himself. Five years later, he would seek my opinion about a pressing personnel decision. What I told him haunts me still.

J.O. came from a distinguished line of surveyors and mountaineers (Sandford 2006). His paternal grandfather (Fig. 1), the family patriarch in this country Arthur Oliver (A.O.) Wheeler (1860–1945), was author of a landmark monograph on the geography and history of the majestic Selkirk Range (Wheeler 1905), co-founder of the Alpine Club of Canada (ACC) in 1906, and commissioner on the Alberta–British Columbia interprovincial boundary survey (1913–24). Yet, his alpine experience began only at the age of 40.

A.O. Wheeler was raised near historic Kilkenny in the southeastern interior of Ireland, the son of land-owning Anglicans long prominent in the area as clergymen, military officers and political leaders. When A.O. was 16, a crash in food prices forced the family to sell their estates in Ireland and emigrate, to Georgian Bay, Ontario in 1876. Four years earlier, a Kilkenny neighbour, Major William Francis Butler (1838–1910), had published *The Great Lone Land: A Narrative of Travel and Adventure in the North-West of America* (Butler 1872). Having volunteered to collect intelligence about the Red River Métis Rebellion and American settlers pressing northward, Butler met with the Métis leader Louis Riel before guiding the British–Canadian military expedition of 1870 to the Red River settlement, where federal authority was restored. Butler stayed on after the expeditionary force departed and was authorized to travel across the Prairies in winter and report on living conditions in the newly acquired western territory. Reaching Rocky Mountain House in early December, he returned to Upper Fort Garry (Winnipeg) by dog team in mid-February, delivering his report to the Lieutenant-Governor two weeks later. Twelve-year-old A.O. Wheeler was one of the many who were captivated by Butler's sensitive and evocative descriptions of Western Canadian landscapes and people in winter. *The Great Lone Land* went through 19 editions in his lifetime. For A.O., his family's destination of Collingwood, Ontario was a gateway to Western Canada.

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Figure 1. Arthur Oliver (A.O.) Wheeler, J.O. Wheeler's paternal grandfather, at the Alpine Club of Canada summer camp for 1912 at Vermilion Pass (1680 m), on the continental divide between Banff (Alberta) and Kootenay (British Columbia) national parks. Photograph by botanist Julia Henshaw, from Sandford (2006) courtesy of the Wheeler family.

Young A.O. Wheeler wasted no time. He worked as an apprentice surveyor on the north shore of Lake Huron in 1876 and assisted land surveyor and (later) pioneer forestry conservationist Elihu Stewart (1844–1935) in mapping the Algoma highlands north of Lake Superior by canoe in 1877. In 1878, he accompanied Stewart in a survey of Aboriginal lands around Prince Albert in the District of Saskatchewan of the (then) North West Territories (Sandford 2006). Certain of his calling, he underwent the academic grind required for Dominion Land Surveyors and joined the Department of the Interior in Ottawa in 1881. Not one to miss out on any action, A.O. along with other Dominion Land Surveyors joined the militia force hastily commissioned by the Conservative government of John A. Macdonald in the Spring of 1885 to quell the North West Rebellion of Saskatchewan Métis under Louis Riel, the Red River Resistance leader returned from exile south of the border. At the decisive Battle of Batoche (May 9-12, 1885), A.O. was grazed in the shoulder by a sniper's bullet two days before the Métis stronghold fell. Back in Ottawa, he was soon smitten by a daughter of the Dominion Botanist at GSC, the legendary Irish-Canadian plant collector John Macoun (1831–1920). Recruited by Sanford Fleming to assist in determining the best route across the Prairies for the Canadian Pacific Railway (CPR), Macoun participated in five survey expeditions between 1872 and 1881. Anomalous rainfall during this period caused him to recommend a southern route through Regina and Calgary as being more favourable for agriculture than a northern route through Saskatoon and Edmonton. The decision by CPR to bypass the northern trade route was one of the many grievances that had led to the North West Rebellion. The route chosen would become part of the Prairie dustbowl in the 1930s. Clara Macoun and A.O. Wheeler had one child, Edward (later Sir Edward) Oliver Wheeler, born in Ottawa in 1890.

After a brief fling as a private surveyor in Greater Vancouver, A.O. returned to the Topographical Branch in Ottawa in 1894, conducting topographical surveys of the irrigation lands south of Calgary and the adjacent Crowsnest Pass mining area for six years (Sandford 2006). It was his next assignment that introduced him to the high mountains. Rogers Pass (1330 m above sea level) offers a narrow route through the northern Selkirk Mountains of eastern British Columbia. It was discovered in 1882 at the behest of the CPR, who wished to shortcut the Great Loop of the Columbia River between Golden and Revelstoke. The construction of a rail line two years later was an engineering triumph, but before the first of two tunnels were bored in 1916, rail service had to be suspended in winter because extreme amounts of snow accumulation (~10 m/yr) caused frequent destructive avalanches. In 1899, an avalanche buried 8 people and destroyed the Rogers Pass train station. In response, A.O. was assigned to carry out the first photo-topographic survey of the Pass and its approaches, the Beaver and Illecillewaet river valleys. The photo-topographic method had been developed by Surveyor General Édouard-Gaston Deville (1849–1924) after the CPR line opened the mountains to miners and developers (Thomson 1967). On the westbound train in 1901, A.O. met the famous English mountaineer and author Edward Whymper (1840–1911), who had led the first ascent of the terrifying Matterhorn (Zermat, Switzerland) in 1865 at the cost of four lives. Whymper was in Canada courtesy of the CPR to drum up interest in Alpine tourism in western Canada. At Rogers Pass, A.O. learned climbing technique and culture from Swiss mountain guides hired by the CPR. This enabled him to reach higher stations for photo-topography. It also instilled in him a thirst to climb peaks for pleasure and a growing conviction that the western mountains should be a conscious part of the national identity. During this defining period of his life, A.O. was accompanied every summer on his surveys and many of his climbs by his son, starting in 1899 when the boy (Oliver to his father) was nine years old and continuing until he was twenty.

E.O. combined the strengths of both his parents (Sandford 2006). A strong climber, he was instrumental in establishing the first ACC mountaineering camps. His academic prowess was even more exceptional. He graduated with top honours from Trinity College private school in Port Hope (Ontario) in 1907, and received the highest grades ever awarded, as well as an unprecedented number of academic and athletics prizes upon graduation from the Royal Military College (RMC) in Kingston (Ontario) in 1910. At the ACC camp that summer, E.O. met the English physician, explorer and mountaineer Tom G. Longstaff (1875–1964), already famous as the first to climb a peak above 7000 m in elevation, Trisul (7120 m) in the western Kumaun (India) Himalaya, in 1907. Together, they traversed Mount Assiniboine (3618 m), the 'Matterhorn of the Rockies,' a 21-hour ordeal that left Longstaff deeply impressed with E.O.'s strength and toughness as a climber (Davis 2012). For E.O., the lure of a region where nearly 100 peaks exceed *twice* the elevation of Mount Assiniboine would prove irresistible.

His performance at RMC qualified him to apply for service in the élite Corps of the Royal Engineers, with the aim of a posting in India. After two years of training in England, he was posted to Dehra Dun, a state capital in the Himalayan foothills north of Delhi and home to many national institutions including the Indian Military Academy and the Survey of India. During his second summer in the country, he hiked into the Gangotri Glacier basin and saw its famous granite towers, the first to appear being Shivling (6543 m), which would not be climbed for another 64 years. It was 1914 and the Great War in Europe was about to begin.

At the age of 24, Major E.O. Wheeler was placed in command of a Company of King George V's Own Bengal Sappers and Miners, attached to the first Indian Division that sailed for France in mid-September, six weeks after war was declared by Britain. Arriving at the Western Front by the end of October, the Company's orders were to protect and reinforce Allied trenches and saps (tunnels or covered trenches directed toward enemy lines), lay and defuse bombs, and destroy whenever possible enemy fortifications, trenches and saps (Davis 2012). The work was done mainly at night under hostile fire. According to dispatches, E.O.'s Indian Company moved to destroy one sap and found it full of enemy soldiers waiting to do the same. Hand-to-hand fighting ensued and when the Germans withdrew, the dead and dying were unceremoniously buried under orders to fill-in the sap. The details will never be known because E.O. never spoke in specifics about his wartime experiences. At one point, E.O.'s parents, who had moved to southern Vancouver Island before the war, heard that their son had been killed in action, just as A.O.'s own parents had been told after the Battle of Batoche (Sandford 2006). E.O. remained in France until late December of 1915, when the shattered Indian Corps was redeployed to Mesopotamia. Out of a total force of 48,000 men, 34,252 had perished including 1,525 officers (over 1,000 British). This at a time when Indian soldiers were not permitted to dine with other imperial troops or to be medically treated by white nurses (Davis 2012). For bravery and distinguished military service, E.O. was awarded the cross of the French Légion d'honneur (Chevalier 5th Class).

The remains of the Indian Corps arrived in Mesopotamia at a bad time. In late 1915, the 2nd (Poona) Division of Indian troops under British command had rashly attempted to extend their control northward to Baghdad from a stronghold in the southern oilfields near Basrah. They were repulsed by Turkish forces outside the capital and had retreated to Kut-al-Amara, where they were under siege without secure lines of supply. Buoyed by news of victory at Gallipoli, the Turks were pressing their advantage. In the early months of 1916, the Indian Corps diverted from France attempted without success to relieve the embattled garrison at Kut, which fell to the Turks on the 29th of April. E.O. was mentioned seven times in dispatches during the campaign and was awarded the Military Cross. In June, 1916, he collapsed with typhoid fever and was invalided back to India for over a year, returning to duty in Mesopotamia in the Fall of 1917, after the British had finally seized control of Baghdad. At war's end, the collapse of the Ottoman Empire created a power vacuum in Mesopotamia which the British intended to fill with the creation of modern Iraq. As part of this effort, E.O. was ordered to conduct a strategic reconnaissance of the potentially hostile Kurdish region around Sulaymaniyah in the mountainous northeast of the country. After completing this assignment, he returned to India in January 1919 as Brevet Major on the General Staff, before being seconded to the Survey of India in December of that year. He visited his parents in Canada for the first time in eight years in 1920 (Fig. 2), a man older than his 30 years but one lucky to still be alive.

E.O. returned to India from Canada in 1920 by way of England, hearing that Tom Longstaff's brother-in-law had died in action leaving Tom's sister Kate a widow with three children. All four had climbed together at Mount Assiniboine in 1910. As it turned out, Kate had arranged for E.O. to meet

Figure 2. Edward Oliver (E.O.) Wheeler (left) with his parents, Clara (Macoun) and Arthur (A.O.) Wheeler, at Banff in the summer of 1920. This was his only visit to Canada following military service in France and Mesopotamia during World War I, and before his marriage and participation in the British Everest Expedition of 1921. Photograph from Sandford (2006) courtesy of the Wheeler family.

a friend of hers who shared his enjoyment of tennis, golf and dancing (Sanford 2006). Five days later, E.O. was engaged to Dorothea (Dolly) Danielsen, whom he would marry in late March 1921 in Bombay. Simultaneously, Tom Longstaff's recommendation led to an invitation for E.O. to join the British Everest reconnaissance expedition of 1921 as a high-altitude surveyor, to map a 500 km^2 area centred on Mount Everest (8848 m) itself, using the Canadian photo-topographic method he had learned from his father. The expedition would depart on the 2700-km-long trek to the foot of Everest from Darjeeling on the 1st of May (Davis 2012). His honeymoon with Dolly would be a short one.

The British Everest expeditions of 1921, 1922 and 1924 were historic for many reasons, not all related to climbing. The strangeness of the post-war period as well as the gripping story of the expeditions and their personnel are brilliantly captured in Wade Davis' book, *Into the Silence* (Davis 2012). The expedition sponsors, the Royal Geographical Society (London) and their financial backers were of one mind: a British triumph of the human spirit was desperately needed to restore a sense of national purpose after the pointless slaughter of the Trench War. At the same time, an unbridgeable chasm existed across society between those who had witnessed the unspeakable carnage and those who had not. For those of my age, growing up 25 years later, the mere mention of mountains instantly conjured up an image of George Mallory and Sandy Irvine, seen momentarily through the swirling clouds and blowing snow, moving upward, high but late on the Northeast Ridge of Everest. It will never be known if they reached the summit. Mallory's body was found on the North Face in 1999, with rope trauma indicating that he and Irvine were roped together when they fell.

The 1921 expedition would be exploratory: Everest (8848 m), the highest mountain relative to sea level in the world, had been sighted and surveyed from a distance in 1856 during the Great Trigonometrical Survey of India (Molnar 1986; Keay 2001), but no Westerner had been closer than 60 km from the mountain, not least because Nepal to the south was closed to outsiders, requiring an approach from the north through Tibet (Fig. 3). The British government, for its part, quietly reversed a longstanding policy against arming the Tibetan government in order to gain consent for the expedition from the Dalai Lama (Bell 1924).

For the climbers (Fig. 4), the topographical survey was somewhat peripheral to the main thrust of the expedition, but during its 5.5 month duration no one was longer at high elevation nor more continuously exposed to the elements than Wheeler and his Tibetan assistants (Fig. 5), Gorang, Lagay and Ang Pasang (Davis 2012). Isolated from the main party for three months, they spent 41 days between 5500 and 6800 m in elevation, hauling 60 kg of equipment to high vantage points every morning, hoping for the one day in six that was clear and calm enough for photo-topography. In all, they obtained 240 images from precisely triangulated positions, from which a preliminary 1:100,000-scale topographic map was produced covering 730 km^2 to the north, west and east of Everest itself (Fig. 6). A month after climbers George Mallory and Guy Bullock had ascended the Rongbuk Glacier (Fig. 7), finding an unclimbable headwall on North Face of Everest, E.O. discovered that a seemingly unimportant meltwater tributary (Fig. 8)

Figure 3. Mount Everest (8848 m) from the north, at a distance of ~63 km and an elevation ~4500 m on the Tibetan Plateau near the village of Tingri. This was the closest any Westerner had come to Everest before 1921. The Northeast Ridge slopes down to the left of the summit. The spur projecting northward toward the camera from the Northeast shoulder descends to the North Col (Chang La), which is out of sight behind the peak of Changtse (4868 m), only the top of which is visible in front of the North East Ridge. The dark coloured rocks in the middle ground are folded Jurassic shales with tight synclines of Cretaceous and Eocene limestone (Heron 1922; Gansser 1964). The Mount Everest massif is composed mainly of Cambrian and Ordovician metasedimentary rocks (Myrow et al. 2009), exhumed in response to north-dipping extensional faulting (South Tibetan Detachment) of Early Miocene age (Burg et al. 1984; Burchfiel and Royden 1985). Photograph taken by Joe Hastings (1900 hr, 13 May 2007).

Figure 4. Members of the 1921 Mount Everest Expedition. Standing (left to right): Guy Bullock, Henry Morshead (surveyor), Oliver (E.O.) Wheeler (high-altitude surveyor) and George Mallory (lead climber). Seated (left to right): A.M. Heron (geologist), Sandy Wollaston, Charles Howard-Bury (expedition chief) and Harold Raeburn. Photograph by Sandy Wollaston courtesy of the Royal Geographical Society.

drained a hidden glacier, the East Rongbuk Glacier, that curled southward toward Everest. The source of this glacier (Fig. 9) was a climbable headwall to the North Col (Chang La) between Everest and Changtse (North Peak). The North Col itself was finally reached via the Kharta Glacier on September 25 by Mallory, Bullock, Wheeler and his three seasoned assistants. Mallory deemed the spur from the Col to the Northeast Ridge (Fig. 10) to be potentially doable in better weather (Mallory 1922). The 1921 expedition had achieved its main objective, to ascertain a route to the summit of Everest. Although Wheeler was not credited in expedition accounts (Howard-Bury 1922; Mallory 1922) as its discoverer, the East Rongbuk

Figure 5. E.O. Wheeler and two of his three Tibetan assistants: Gorang, Lagay and Ang Pasang. Using a Canadian-designed photo-topographical survey camera with 12 x 17 cm plates, Wheeler took 240 single images and panoramas of the northern, western and eastern approaches to Everest, from which the first accurate topographical map of the area was constructed (Fig. 6). The technique required clear and relatively calm conditions, seldom encountered at elevations above 5000 m (wrt sea level) where the team worked for long periods. Photograph in 1921 by Sandy Wollaston courtesy of the Royal Geographical Society.

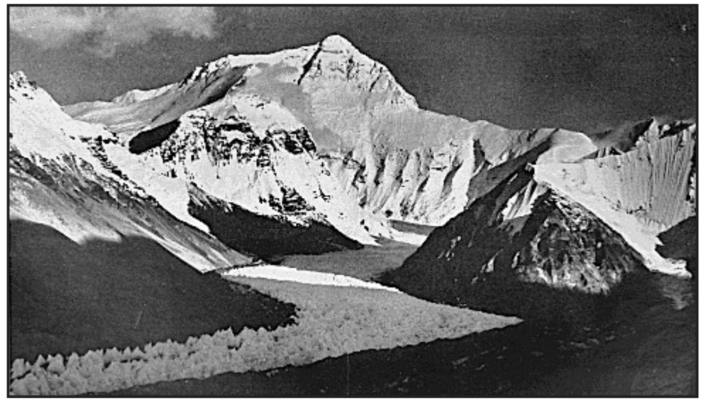

Figure 7. Mount Everest from a distance of 14.5 km on the west side of the Rongbuk valley near the confluence of the Rongbuk and West Rongbuk (hidden, lower right) glaciers. Changtse (4868 m) is the peak in front of and to the left of Everest, to which it is connected by the North Col (Chang La), the only feasible route to the summit of Everest from the north. The ascent to the North Col from the west, via the Rongbuk Glacier (foreground), was deemed to be too difficult on inspection. Photograph in 1921 by George Mallory courtesy of the Royal Geographical Society.

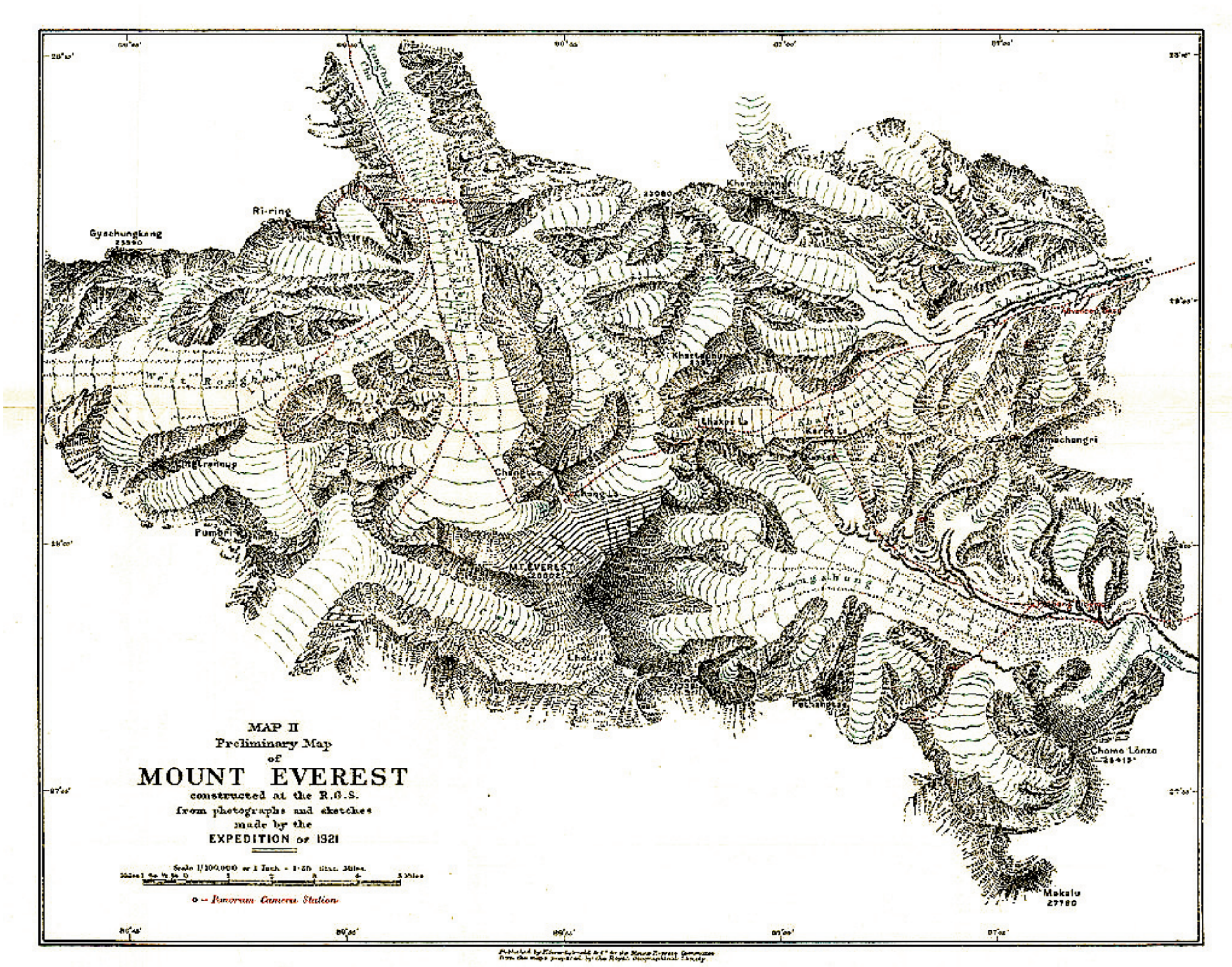

Figure 6. Preliminary Map of Mount Everest constructed at the Royal Geographical Society from photographs and sketches made by the Expedition of 1921 (Howard-Bury 1922). At a scale of 1:100,000, the map was a product of E.O. Wheeler's three-month photo-topographical survey (Davis 2012). Routes taken by the climbers during the 1921 expedition are indicated in red.

Figure 8. Meltwater drainage outlet from the East Rongbuk Glacier (hidden) onto the Rongbuk Glacier, viewed from the same location as in Figure 7. At this spot on July 5th, 1921, Mallory with Guy Bullock decided that the North Col could not be reached from the Rongbuk valley, assuming the drainage outlet shown here did not head southward toward Everest. As a result, the expedition redirected its effort to the east, via the Kharta Glacier and Windy Gap (Lhakpa La). On August 3rd, however, E.O. Wheeler in the course of his topographical survey ascended the drainage outlet and discovered the East Rongbuk Glacier as a direct route to the North Col. The significance of Wheeler's discovery was never acknowledged in expedition reports (Howard-Bury 1922; Mallory 1922). Photograph in 1921 by George Mallory courtesy of the Royal Geographical Society.

Figure 9. Headwall of the East Rongbuk Glacier, viewed from 5.5 km to the northeast at Windy Gap (Lhakpa La). The North Col (Chang La) is on the right, from which a climbable spur (Fig. 10) leads up to the shoulder of the Northeast Ridge of Everest. This was the route used in the summit attempts of 1922 and 1924. In early June, 1922, an avalanche below the North Col killed seven Sherpa porters, out of respect for whom the final expedition was delayed for a year. Photograph in 1921 by Charles Howard-Bury courtesy of the Royal Geographical Society.

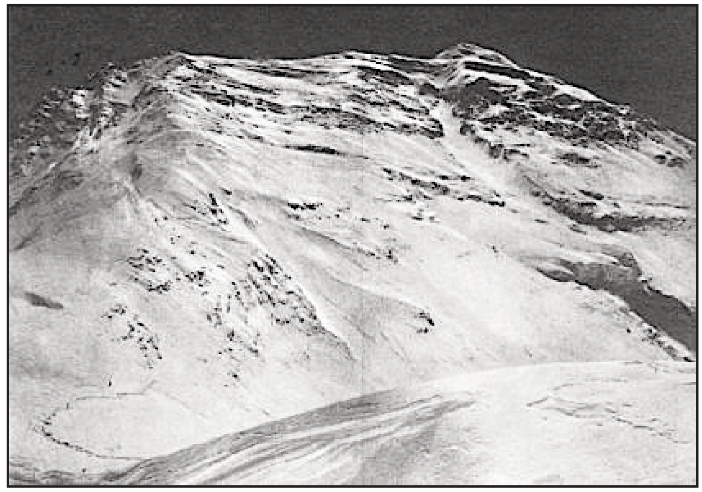

Figure 10. Route to the Northeast Ridge from the North Col (lower left). The summit of Everest can be seen beyond the Ridge. The North Col (Chang La) was reached at the end of the climbing season (September 25) in 1921, but poor weather prevented further ascent. The route was used in the summit attempts of 1922 and 1924. Photograph in 1921 by George Mallory courtesy of the Royal Geographical Society.

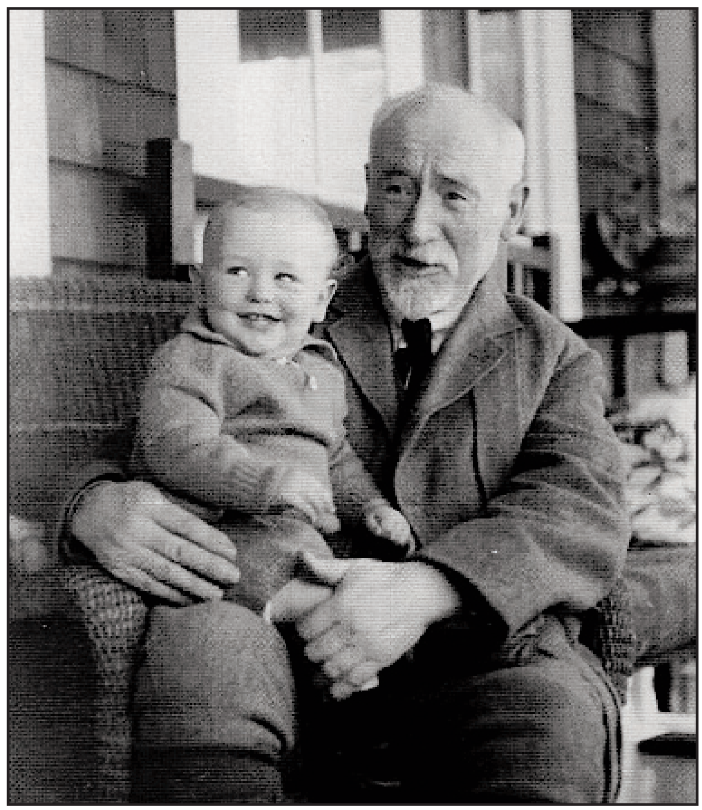

Figure 11. Arthur (A.O.) Wheeler and his only grandson, John (J.O.), aged one and a half, on his first visit to Canada in 1926. Photograph from Sandford (2006) courtesy of the Wheeler family.

Glacier was the key to the mountain from the north. It was the route used for the summit attempts of 1922 and 1924, and all subsequent Everest expeditions before 1938.

After the 1921 Everest expedition, E.O. returned to the Survey of India. In 1924 he was put in charge of the Northern Survey, based at the hilltop resort town of Mussoorie on the outskirts of Dehra Dun (Sandford 2006). It was there that Dolly and E.O.'s son John (J.O.) was born on 19 December 1924 (Fig. 11). Had they stayed, J.O. would have learned that Mussoorie lies within a doubly-plunging syncline of Ediacaran and Cambrian sedimentary rocks (Krol and Tal groups), at the base of which is a Cryogenian glacial diamictite (Blaini Formation) with a diagnostic Marinoan (635 Ma) 'cap dolomite' (Brookfield 1987; Jiang et al. 2003). The family moved, however, to Quetta in 1926, when E.O. was put in charge of the Western Survey (now Pakistan). In 1933, 8-year-old J.O. was enrolled at the Shawnigan Lake School on southern Vancouver Island (Fig. 12), where he would spend summers hiking with his grandfather who had remarried after Clara Wheeler's death the year before J.O. was born. J.O.'s father meanwhile would

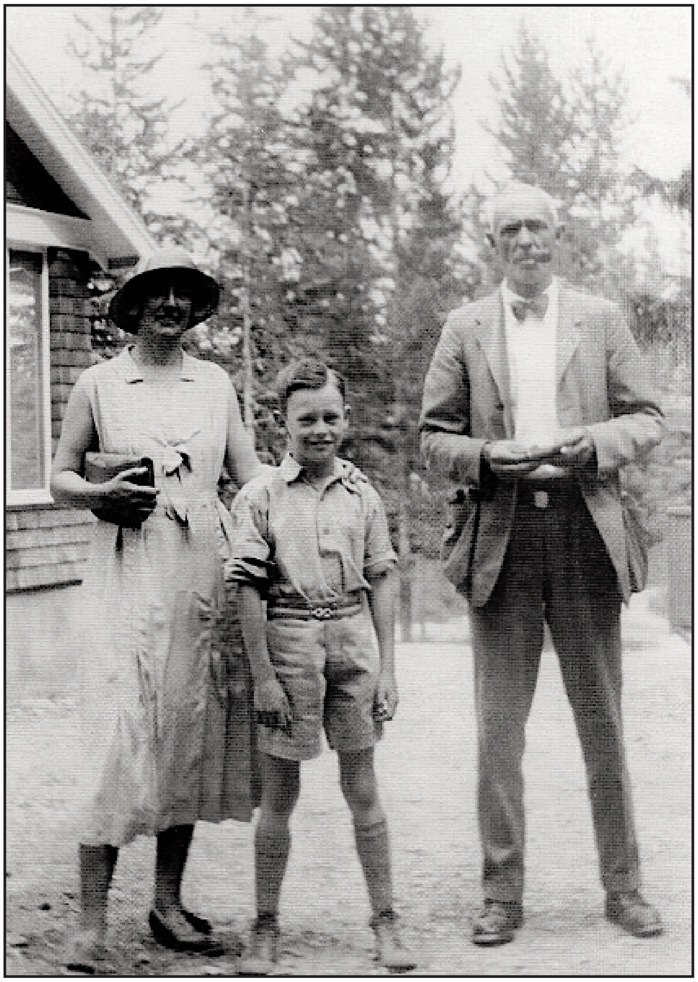

Figure 12. Eight year old John (J.O.) Wheeler with his parents, Dorothea (Dolly) Danielsen and Oliver (E.O.) Wheeler, at Banff prior to his parents' departure for India in August, 1933. J.O. was about to be enrolled at the Shawnigan Lake School on southern Vancouver Island. Photograph from Sandford (2006) courtesy of the Wheeler family.

soon move to Shillong to head the Eastern Survey, before being seconded to Calcutta in 1934 as Assistant Surveyor General, then Director of the Geodetic Branch, and finally Surveyor General of India in 1941. On his watch, the Survey ramped up production of topographical maps (to 20,000 a year) in response to the military threat posed by the Japanese occupation of British colonial Burma in 1942. Credited with helping to stave off a Japanese invasion of eastern India, E.O. Wheeler was knighted in 1943. After retiring from the Survey in 1947, he and Dolly moved to British Columbia, where they lived near Vernon in the Okanagan region. He served as President of the ACC (1950–54), the organization he had helped his father create as a teenager. He died in Vernon in 1962 following a stroke.

J.O. saw his parents only intermittently during his nine years at Shawnigan Lake School (1933–42) and four years at the University of British Columbia (UBC) in Vancouver (1943–47), where he graduated in geological engineering, with the encouragement of his grandparents, the year his parents returned from India (Sandford 2006). Like his father, J.O. was a gifted athlete and climber, and he worked for exceptional men as a student assistant with GSC for three summers. In southwestern Yukon, he assisted Hugh S. Bostock (1901–94), the 'father of Yukon geology' and grandfather of current UBC seismologist Michael Bostock. In the Omineca Mountains of northern British Columbia, he assisted his near-contemporary Fred Roots (1923–), who would soon be senior geologist on the first multi-national (Norwegian–British–Swedish) Antarctic Expedition (1949–52), later co-leader and leader respectively of major GSC projects in the High Arctic (Operation Franklin 1955) and northern Cordillera (Operation Stikine, 1956–58), and founding coordinator of the Polar Continental Shelf Project (1958–71).

J.O.'s PhD thesis project at Columbia University was on the geology of the Whitehorse (1:125,000 scale) map-area of southern Yukon, a project begun by Quaternary geologist John G. Fyles (1923–2005) and completed by J.O. during the summers of 1948–51 (Wheeler 1952). J.O. joined the permanent staff of GSC in Vancouver in 1951 (Zaslow 1975), but completion of his thesis was delayed by two new GSC projects for which very few were qualified in terms of strength, experience and temperament. The first was a geological reconnaissance of the remote northern Selwyn Mountains of eastern Yukon in 1952. Embarking soon after his marriage to Nora Jean Hughes in Vancouver, this four-month 800-km long expedition was described by no less than Hugh Bostock as *"perhaps the longest and loneliest packhorse journey for the Survey ever in the Yukon if not anywhere in the Cordillera"* (Bostock 1990). The second project, even more challenging physically, involved geological mapping in the heavily glaciated eastern St. Elias Mountains of southwestern Yukon in 1953–55. By the time of his thesis defence in 1956, J.O. had logged 10 long field seasons in the northern Canadian Cordillera, at a time when camp moves were done by packhorse train.

Over the next 13 years (1956–69), J.O. would devote another 10 field seasons to geological mapping, split between the southern Yukon and eastern British Columbia (Sandford 2006). He became Head of the Cordillera and Pacific Margin Section of GSC in Vancouver in 1967, by which time he was personally familiar with both the eastern and western Cordilleras, in the Yukon and in British Columbia. The geographical range of his knowledge was vital because a transect approach at the scale of the orogen is unrewarding (or worse) in the Canadian Cordillera due to large-magnitude, orogen-parallel, strike-slip faults, the displacement histories of which remain controversial. Jack Oliver (1923–2011), the Columbia (later Cornell) University seismologist who tested the transform fault concept as a corollory of sea-floor spreading (Isacks et al. 1968), used to joke that the challenge in geophysics is *analysis*, because data are too few, whereas the challenge in geology is *synthesis*, because data are too many (Oliver 1996).

In 1969, GSC had the foresight to send five of its Vancouver-based geologists (Hu Gabrielse, Bill Hutchison, Jim Roddick, Jack Souther and John Wheeler) to the 2nd Penrose Conference at Asilomar (California) on *"The Meaning of the New Global Tectonics for Geology,"* convened by William R. (Bill) Dickinson (1931–2015). Out of the blue, a vision had arisen that unified the major features of the Earth's crust—passive and active continental margins, oceanic trenches and ridges, great faults, volcanic arcs and rifts—a vision that validated continental drift and provided an entirely new way of interpreting orogenic systems like the North and South American

Cordilleras. This was not a paradigm shift as envisioned by Thomas Kuhn (1922–1996), one that resolved a growing crisis of confidence in existing theory (Kuhn 1962), for no sense of crisis existed in geology or geophysics before the plate tectonics revolution. Only afterwards was it apparent that we had been stuck in neutral. Given the potential to interpret the Cordillera genetically for the first time, it cannot have been easy for J.O. to accept a senior management position in 1970 (Fig. 13), and one so far from an active plate boundary as Ottawa.

J.O.'s decade in Ottawa (1970–79) was one in which I lay low. Having identified the Coronation 'geosyncline' as a 1.9 Ga west-facing rifted continental margin, from reconnaissance (Fraser et al. 1971), taking the next step—determining how the margin had been destroyed—required six seasons of 1:250,000-scale mapping, first in the Great Bear magmatic zone assisted by Ian Bell, Mike Cecile and Rein Tirrul, and then in the Hepburn metamorphic-plutonic belt assisted by Mike Easton and Marc St-Onge. Moreover, I was away from Ottawa for half the years that J.O. was there.

At a conference in 1980, J.O. came over after my talk and asked if he could have a word with me privately, in his hotel room the next morning. I hadn't the slightest idea why he wanted to see me, except that it wouldn't be about my talk. When I came to his room, he motioned for me to sit down and, perfunctories exchanged, asked me point-blank what I thought about promoting John McGlynn, then a Section Head and my longtime mentor at GSC, to Chief of the Precambrian Division. GSC at this time had a 'flat' management structure. Division Chief was the key operational position: Division Chiefs did the hiring and set the programs and budgets. They reported directly to the Director General, and because there were many Divisions, each Chief had considerable autonomy.

John C. McGlynn (1926–99) had joined GSC in 1950 with a PhD in geology from the University of Chicago. He had been Resident Geologist in Yellowknife before I worked as his field assistant, in 1963 on the medial zone of Wopmay orogen and 1965 on the Nonacho basin of the Rae craton. It was through his recommendation that my thesis proposal for a sedimentological study of the Great Slave Supergroup was approved and funded by GSC. It was at the home of John, his wife Lillian (MacDougal) and their four sons that I stayed on my frequent visits to Ottawa as a graduate student in Baltimore, and where I enjoyed many a Sunday dinner after I moved to Ottawa. It was there also that I met my future wife, Jean (Erica) Westbrook.

Of Irish descent from London (Ontario), John McGlynn was funny and irreverent. A Trudeau Liberal (*"Alberta in fact did well by his oil pricing policy."*), he was fascinated by politics and politicians. He was attracted to exceptional people, his then ongoing collaboration with geologist-paleomagnetist Edward (Ted) Irving (1927–2014) being a fruitful example (Fig. 14). He was a gifted story teller who relished the absurdities of life, but he was also a magnetic listener (Fig. 15), a person people opened themselves up to. I loved John like a father, but in my innocence I had doubts about his suitability as a Division Chief. He was a nervous type, and most of his normal day was spent chatting with people around the office. When it came to writing, he didn't have a lot to show for 30 years at GSC. I was afraid he would be crushed by the job, and that's what I told J.O.

I never heard anything more about it for several months, when it was officially announced that John McGlynn would

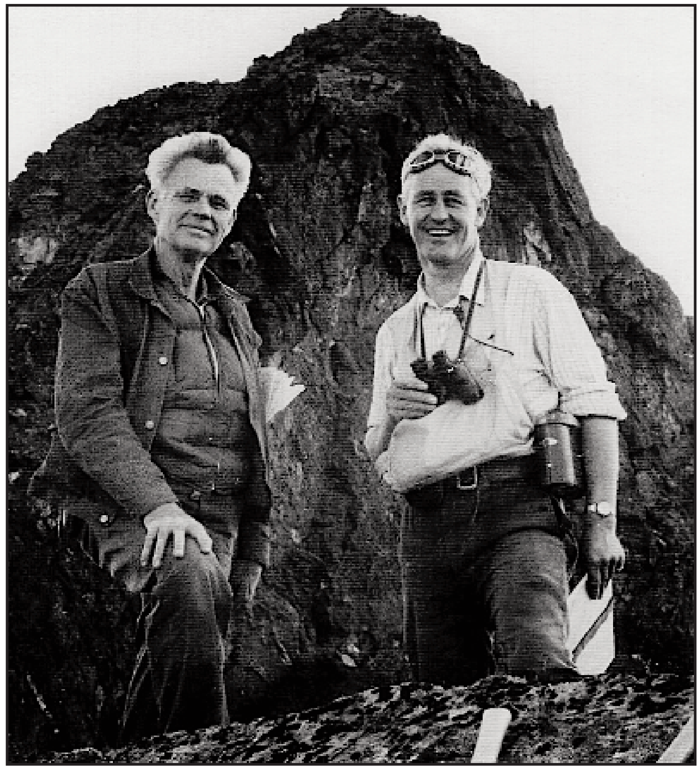

Figure 13. Appalachian structural geologist John Rodgers (1914–2004) of Yale University, President of the Geological Society of America, and John (J.O.) Wheeler (1924–2015), President-Elect of the Geological Survey of Canada, in Mount Revelstoke National Park, August 1970. Photograph from Sandford (2006) courtesy of the Wheeler family.

Figure 14. John McGlynn (left) and Edward (Ted) Irving, drilling paleomagnetic samples on the Slave craton in 1973. In the 1950's, Irving was the first geologist to demonstrate continental drift paleomagnetically (Irving 1956; Frankel 2012, 2014), thereby setting the stage for the New Global Tectonics (aka plate tectonics) of the 1960's. In the 1970's, Irving directed most of his research to paleomagnetic studies in the Canadian Shield, and McGlynn was his most frequent collaborator. GSC photograph courtesy of Lillian McGlynn.

Figure 15. Edward (Ted) Irving (second from left) and John McGlynn (right), planning sampling strategy for Paleoproterozoic mafic dykes on Slave craton, at a GSC camp on Indin Lake (NWT) in 1973. Assistant geologists Rosaline Goodz (left) and unidentified (second from right) listen in. Mafic dykes are excellent targets for paleomagnetism, but in the 1970's they could not be accurately or precisely dated radiometrically. GSC photograph courtesy of Lillian McGlynn.

replace Ira Stevenson, then (acting) Division Chief, a position he would hold with distinction until GSC was restructured in 1987. John turned out to be a brilliant research manager and the Division flourished under Directors General Bill Hutchison and Ray Price. Among the geologists John McGlynn hired were Jean Bédard, Rob Berman, Simon Hanmer, Robert Hildebrand, Janet King, Bruce Kjarsgard, Steve Lucas, Randy Parrish, John Percival, Tony Peterson, Chris Roddick, Marc St-Onge, Rein Tirrul, Otto van Breemen, Cees van Staal and Joe Whalen. John was shrewd as a manager. Never one to suppress freedom of expression normally, he absolutely forbade any negative talk by us at periodic weekend 'retreats,' where GSC senior managers met with research scientists from every Division. Senior management got the impression that we were a pretty agreeable and positive bunch. Meanwhile, other Division Chiefs would often confide in John (chronically underestimated) their plans to outmaneuver their main competitors. In politics as in poker, it helps to know the others' cards in advance. As Division Chief, John created the strictly unofficial positions of Division geophysicist (seismologist Alan G. Green) and geologist (me). We were to advise him on technical matters and recruitment. He would of course have sought our views in any case, as he did nearly everyone's. More often than not, John did not follow my advice (I can't speak for Alan), but most others thought he did. Those who didn't agree with his decisions tended to blame me or Alan for them, which didn't bother either of us in the slightest.

During John's tenure as Chief, a state-of-the-art U–Pb geochronology facility was established in the Division by Otto van Breemen, Chris Roddick and Randy Parrish. LITHOPROBE, the multidisciplinary brainchild of J.O., who chaired its first steering committee, was established in 1984 with major involvement by Division scientists. Arguably John's greatest achievement was the smooth merger of the Earth Physics Branch with GSC in 1986. This was a potentially explosive situation in which, in effect, Earth Physics was demoted from an independent Branch to a Section within his Division. Doubtless, John's earlier successful collaboration with Ted Irving gave Earth Physics Branch scientists reassurance. In 1987, GSC was one of the few geological surveys in the world that was far stronger than it had been a decade earlier, fully able to take advantage of the conceptual breakthroughs of the New Global Tectonics.

I have often thought about my meeting with J.O. in his hotel room 35 years ago. I think about how J.O. saw in John McGlynn what I did not. I have tried to learn from his example, to see a person for what they *could* do, rather than what they could not.

There is a revealing passage in Wade Davis' book (Davis 2012) on the Mallory expeditions to Everest. Davis describes interviewing J.O. in Vancouver in 2000 (Fig. 16), noting that his own father had attended Shawnigan Lake School on Vancouver Island around the time that J.O. did, and that he (Wade) had climbed several peaks in the Yukon first surveyed by J.O. *"We met for a long afternoon,"* he writes, *"at the end of which he produced a remarkable treasure. According to Everest historians, only Guy Bullock kept a complete journal during the 1921 expedition, curt notes that were published in two parts in the Alpine Journal* [in 1962]. *Mallory wrote letters and Howard-Bury official dispatches, but neither kept a daily account. E.O. Wheeler, as it turned out, did—two complete volumes that had never been seen by anyone outside of his immediate family."*

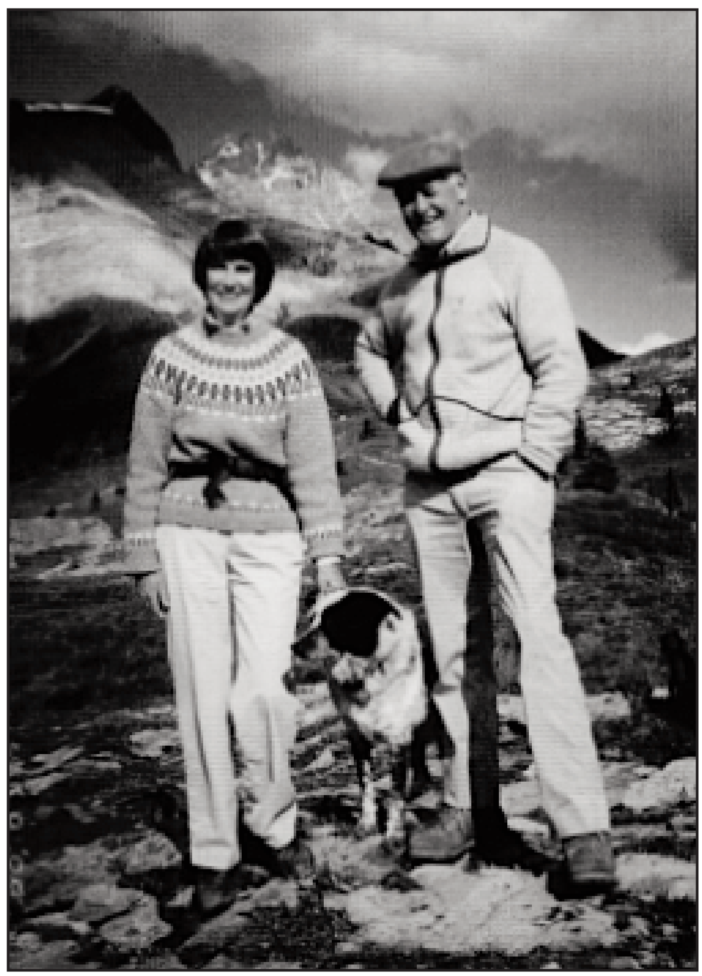

Figure 16. Nora Jean (Hughes) and John (J.O.) Wheeler with their dog Mike on a hiking trip in the Rockies. Undated photograph from Sandford (2006) courtesy of the Wheeler family.

"I was so astonished," Davis continues, *"that I could not bring myself to ask that they be copied. But as we departed late in the day, John Wheeler handed me the two journals, saying simply that he thought I would find them useful."*

It is so characteristic of J.O. that I suspect it was at his insistence that the reader only learns of this exchange on page 584, well into the Annotated Bibliography.

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CORRECTION

In my column on James Smith (Geoscience Canada, 2015, v. 42(1), p. 7–26), I intimated that Charles Darwin was the only English-speaking geologist who seriously referred to Jens Esmark's 1826 glacial theory during the glacial controversy of 1837 to 1865. Although not strictly a geologist, glaciologist James David Forbes discussed Esmark's theory with approval in his book, *Norway and Its Glaciers, Visited in 1851*, published in 1853 in Edinburgh. Forbes is the subject of an exceptionally erudite biography written by former Simon Fraser University historian, Frank F. Cunningham. *James David Forbes, Pioneer Scottish Glaciologist* was published in 1990 by Scottish Academic Press, Edinburgh.